

Air Toxics Data Analysis

Madeleine Strum

EPA/OAQPS

Air Quality Assessment Division



Topics

- Analyses of NATTS
- Other data analysis tools- states, EPA/OECA
- 2011 NATA
- Request for feedback- sharing data, analysis methods, etc.
 - Data analysis workbook
 - Air Toxics Archive
 - Air toxics data analysis workshop/meetings



Air Toxics Data Analyses

- Looking at data measured at NATTS sites – distribution of concentrations, how they compare to risk benchmarks (1 per million cancer risk), MDLs

Concentration benchmarks corresponding to a 1 in 1 million cancer risk or a hazard quotient of 1 for noncancer effects

Provides a way to provide context to the concentrations absence of NAAQS

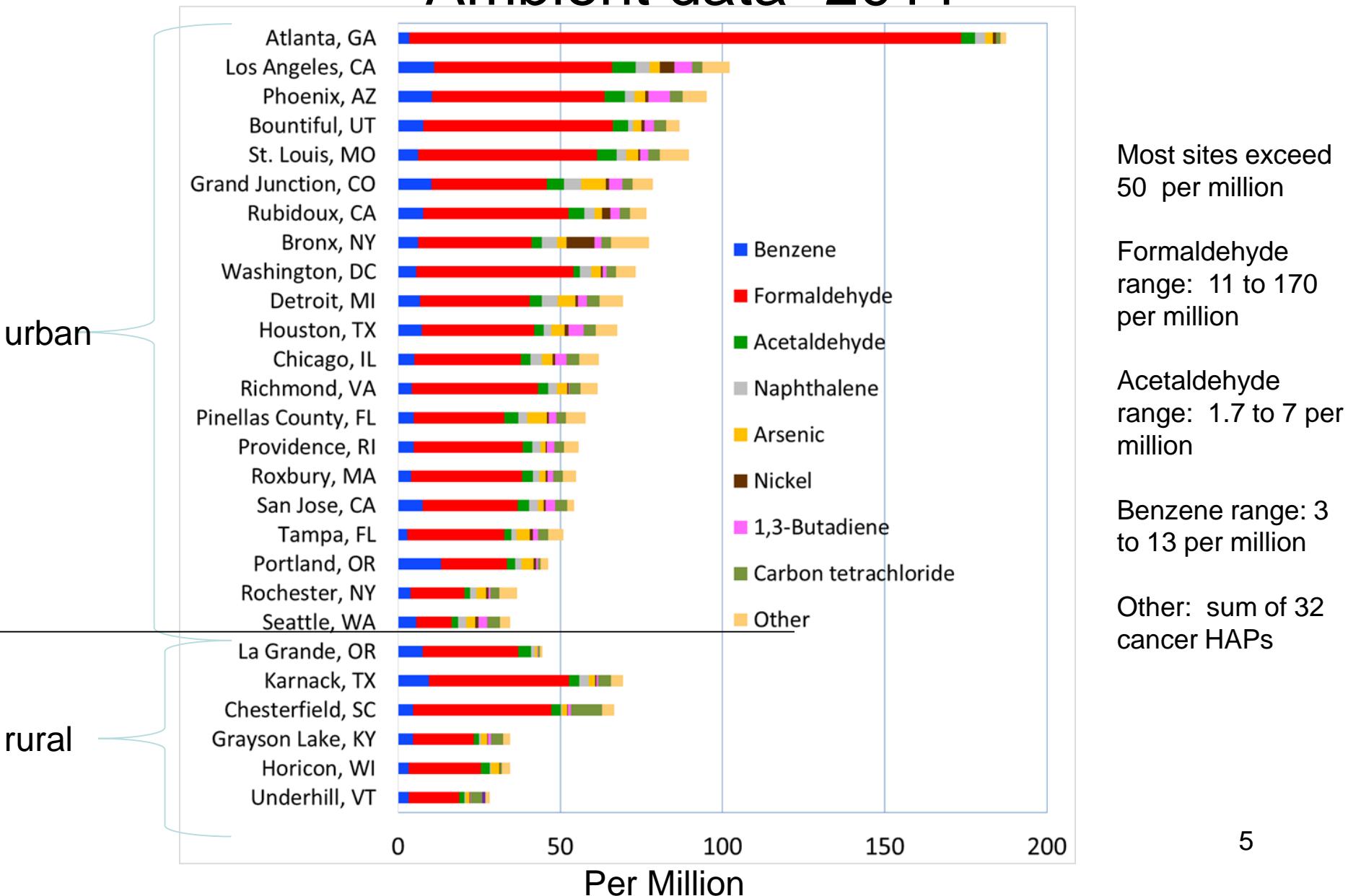
Warning:
health
benchmarks
change!

Pollutant	HEALTH BENCHMARKS *	
	1 per million cancer risk	Hazard Quotient = 1
Chromium (VI)	8E-05	0.1
Arsenic	2E-04	0.015
Beryllium	4E-04	0.02
Cadmium	6E-04	0.01
Benzo[a]Pyrene	6E-04	N/A
Ethylene Dibromide	2E-03	9
Nickel	2E-03	0.09
Ethylene Oxide	0.01	30
Acrylonitrile	0.01	2
Naphthalene	0.03	3
1,3-Butadiene	0.03	2
Ethylene Dichloride	0.04	2400
Formaldehyde	0.08	9.8
1,4-Dichlorobenzene	0.09	800
Vinyl Chloride	0.11	100
Benzene	0.13	30
Carbon Tetrachloride	0.17	100
Trichloroethylene	0.21	2
Ethyl Benzene	0.40	1000
Acetaldehyde	0.45	9
Tetrachloroethylene	3.8	40
Methylene Chloride	63	600
Chloroform	N/A	98
Toluene	N/A	5000
Lead	N/A	0.15
Manganese	N/A	0.3

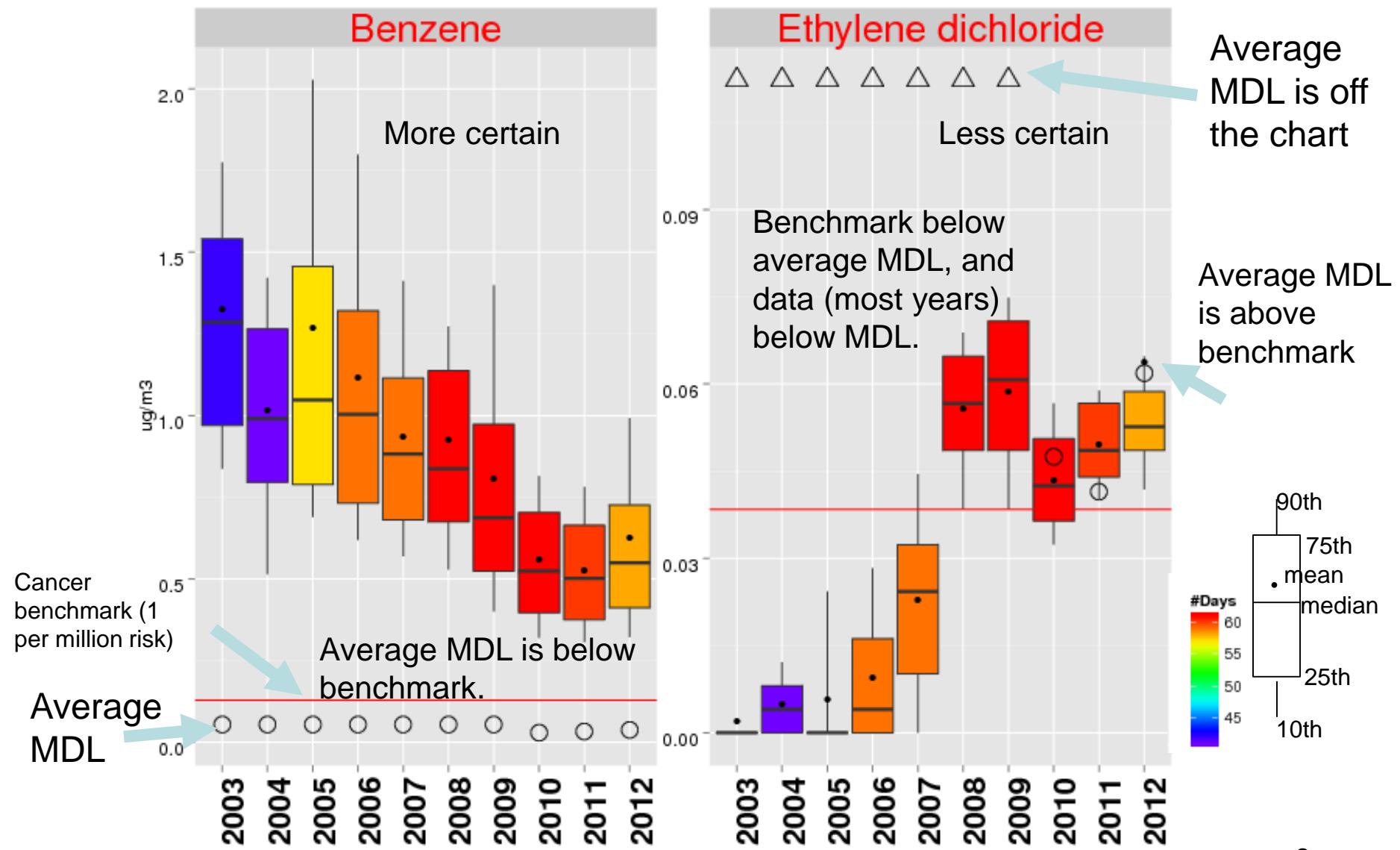
Highest risk HAPs, concentrations above MDL

* based on chronic inhalation unit risk estimates and reference concentrations used by EPA. Cancer benchmark adjusted upward by 1.6 for HAPs with mutagenic mode of action

Cancer Risk across NATTS sites based on Ambient data- 2011



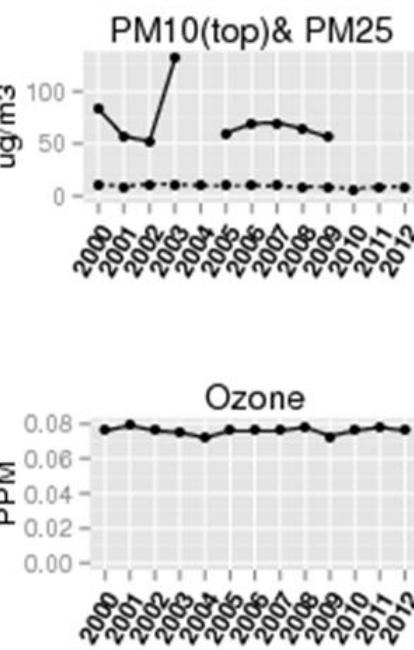
Example: Benzene & Ethylene Dichloride at Roxbury, MA



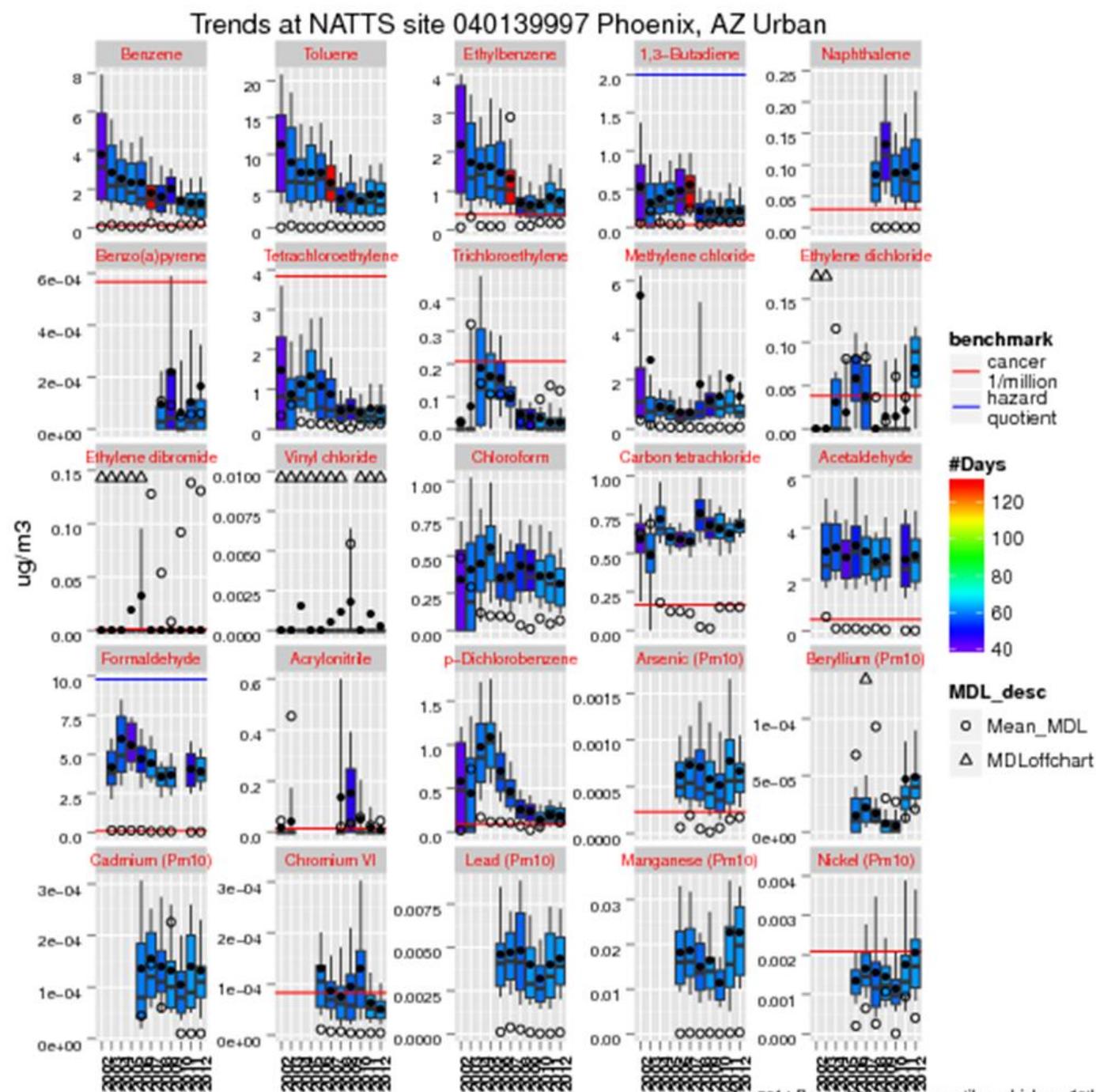


Pollutant trends across NATTS sites



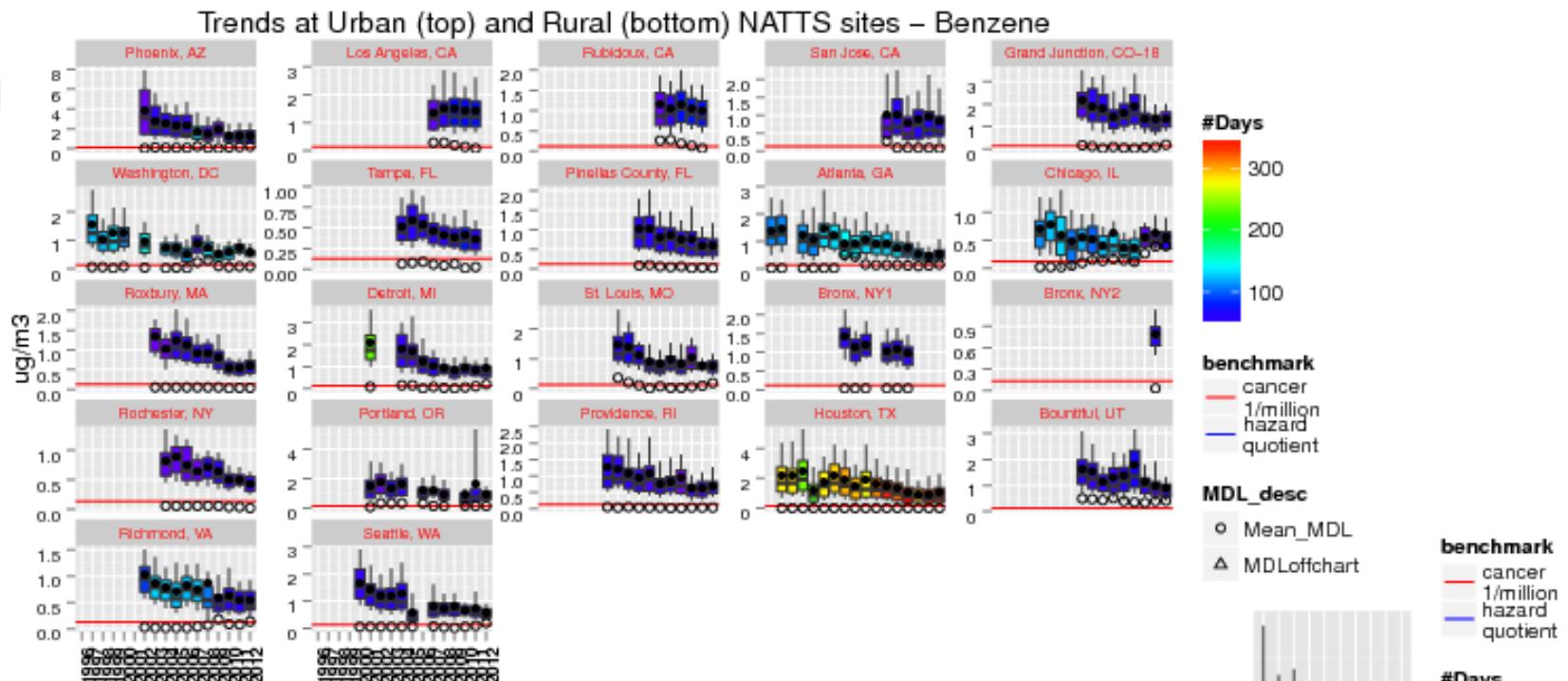


Health Benchmarks (ug/m ³)		
	hazard quotient	cancer risk 1 per million
Benzene	5e+03	NA
Toluene	Se+03	NA
Ethylbenzene	1e+03	0.4
1,3-Butadiene	2	0.0333
Naphthalene	3	0.0294
Benzo(a)pyrene	NA	0.002568
TetraChloroethylene	40	3.85
Trichloroethylene	2	0.208
Ethylene dibromide	9	0.00167
Methylene chloride	600	62.5
Ethylene dichloride	2.4e+03	0.0365
Vinyl chloride	100	0.114
Chloroform	90	NA
Carbon tetrachloride	100	0.167
Acetaldehyde	9	0.455
Formaldehyde	9.8	0.0769
Acrylonitrile	2	0.0147
p-Dichlorobenzene	800	0.0909
Arsenic (PM10)	0.015	0.002233
Beryllium (PM10)	0.02	0.00417
Cadmium (PM10)	0.01	0.002595
Chromium VI	0.1	6.33e-05
Lead (PM10)	0.15	NA
Manganese (PM10)	0.3	NA
Nickel (PM10)	0.09	0.000265

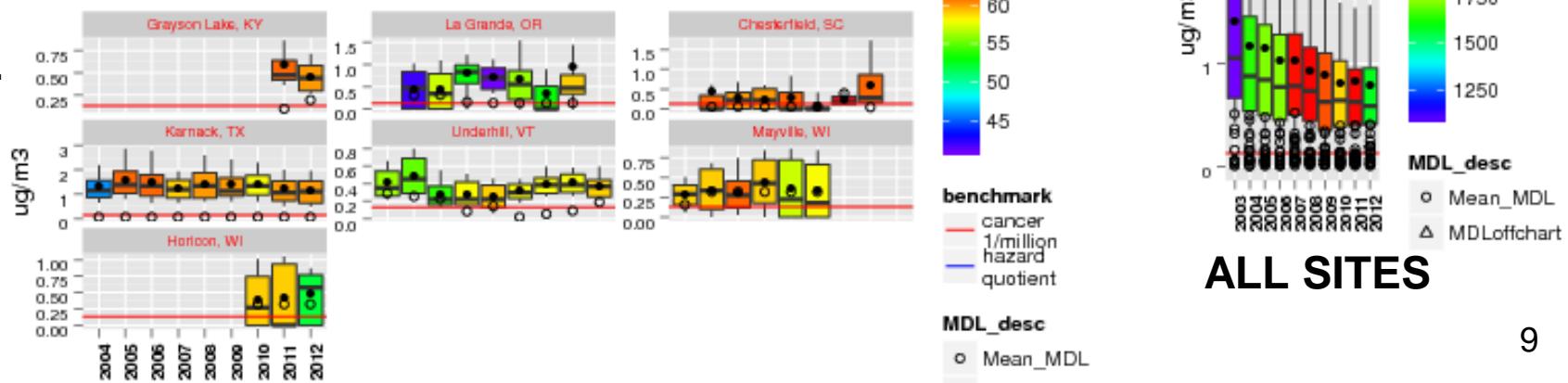


BENZENE ACROSS NATTS

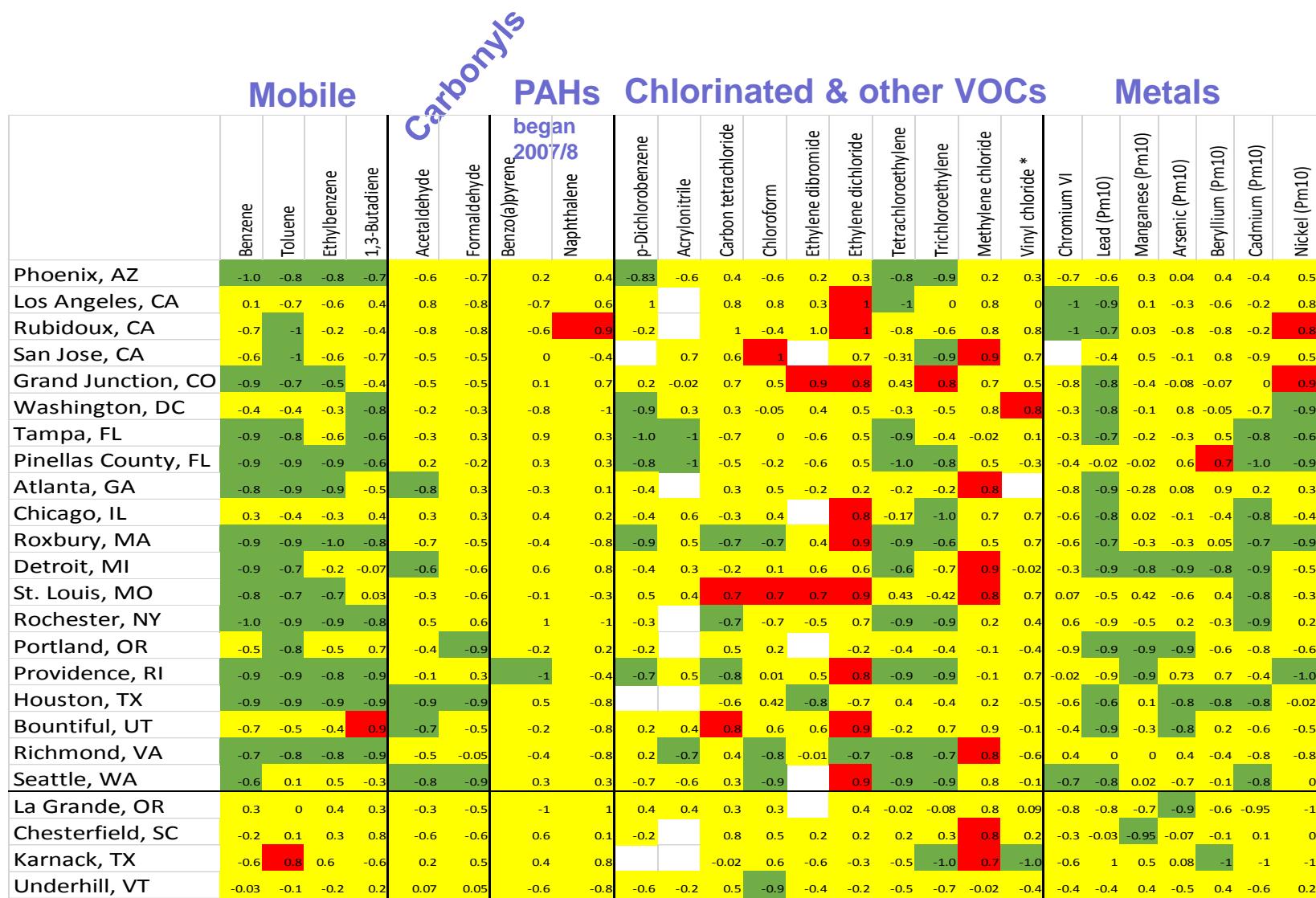
URBAN



RURAL



HAP Trends at NATTS, 2003-2012 Correlation/significance based on Spearman Rank Correlation



Decreasing

Increasing

Not significant



Mapping/analysis tools

- Short term– put charts in mapping tool
- Longer term – NATTS assessment (including emissions from NEI) in mapping tool
- Also looking at other ways to display data based on existing tools at IDEM/MNPCA
- EPA/OECA



State-developed data tools for air toxics ambient data (under development)

- IDEM- contacts: Kali Frost (KFrost@idem.IN.gov), Eric Bailey (ebailey@idem.in.gov)
 - Toxwatch – charts, timeseries, raw data, risk info
 - Metals tool – plots of metals data for all monitors, side by side. Maps of emissions. Draft site--
<https://kfrost.shinyapps.io/INmetals/> -- use google chrome)
 - Lake tool (provides pollution roses associated with Lake monitor)
- MNPCA – contacts: are Cassie McMahon (cassie.mcmahon@state.mn.us) and Dorian Kvale (dorian.kvale@state.mn.us)
 - Maps, charts, trends by pollutant/site. Draft site---
https://mpca.shinyapps.io/Air_Toxic/ -- use google chrome

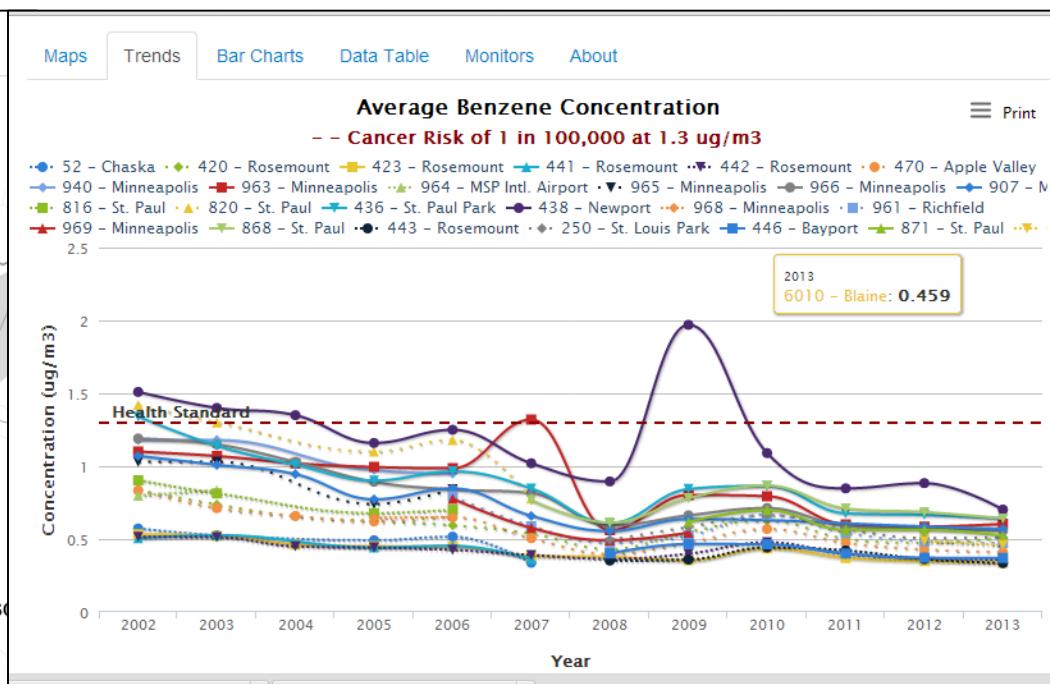
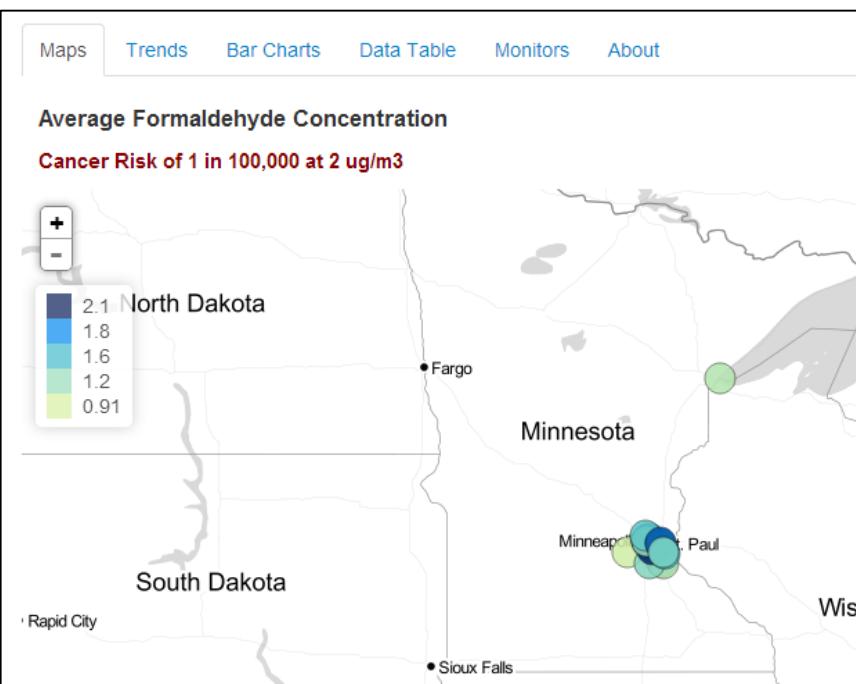
Screenshots – TOXWATCH (Indiana)

The image displays two side-by-side screenshots of the Indiana Air Toxics Monitoring website. Both screenshots show data for Gary IITRI from January 01, 2012, to December 31, 2012.

Left Screenshot (Gary IITRI - Boxplot): This screenshot shows a boxplot for Gary IITRI. The y-axis is labeled "Concentration ($\mu\text{g/m}^3$)" ranging from 0 to 3. The x-axis is labeled "Month" with categories 01 through 12. A green box represents Benzene, showing concentrations generally below 1 $\mu\text{g/m}^3$. A red box represents Acetone, showing concentrations mostly below 1 $\mu\text{g/m}^3$ with a notable peak around 0.8 $\mu\text{g/m}^3$ in month 09.

Right Screenshot (Gary IITRI - Time Series): This screenshot shows a time series plot for Gary IITRI from January 01, 2013, to December 31, 2013. The y-axis ranges from 0 to 8. The x-axis shows months from Feb to Aug. Two data series are plotted: Acetone (red line) and Benzene (green line). Acetone shows several sharp peaks, notably reaching approximately 7.5 $\mu\text{g/m}^3$ in March and 6.5 $\mu\text{g/m}^3$ in June. Benzene remains relatively low, staying mostly below 1 $\mu\text{g/m}^3$.

Screenshots – MNPCA (air toxics data)





OECA's Use of ambient data – mapping tools

- Use to identify facilities in vicinity of ambient air monitors that had measured HAP concentrations above levels of concern, and where modeled data for monitor location is lower than measured
 - Currently available only to EPA
- Developing enhanced tools using this approach that will allow custom searching and filtering of datasets
 - Public data sets (air monitoring data, NATA, and NEI) will be made available through web services



National Air Toxics Assessment (NATA)

- Characterization of health risks for air toxics
 - Nationwide assessment for 178 hazardous air pollutants (HAPs) plus diesel particulate matter (DPM)
 - Modeled estimates of *inhalation exposures* from *outdoor sources*
 - *Cancer and noncancer risk estimates* for 139 HAPs with health data based on *chronic exposures reported at census tract resolution**
- Provides risk estimates for EPA and State/Local/Tribal Agencies to prioritize pollutants, emissions sources and locations of interest

* The public website for NATA presents data at the census tract level. Some results are available for researchers at the census block level.

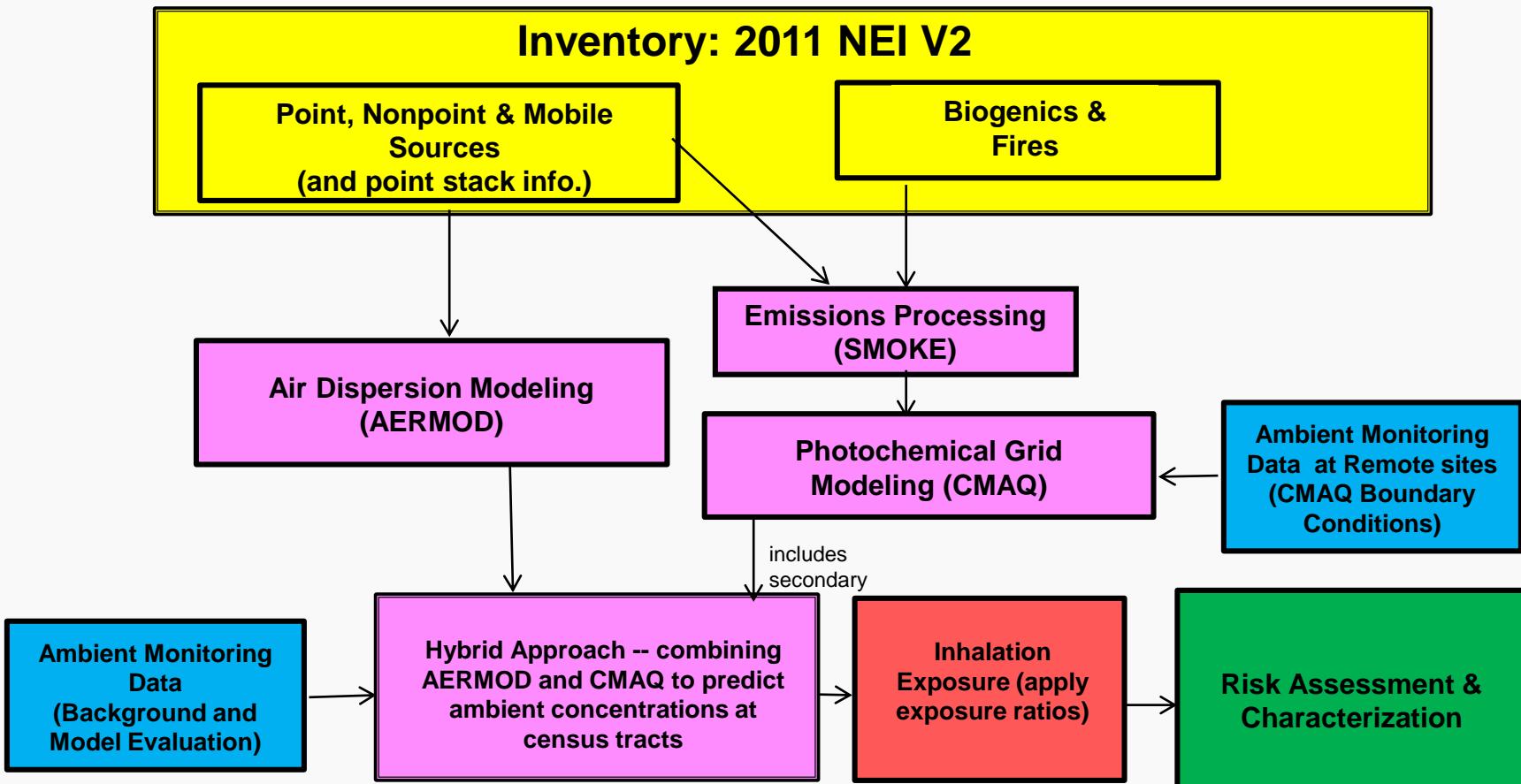


NATA History

- **1996 NATA**
 - Based on 1996 National Toxics Inventory (NTI)
 - Released in May 2002 (6 year lag)
 - 33 HAPs + DPM
 - Census tract resolution
- **1999 NATA**
 - Based on 1999 National Emissions Inventory (NEI)
 - Released in February 2006 (7 year lag)
 - 177 HAPs + DPM
 - Census tract resolution
- **2002 NATA**
 - Based on 2002 NEI
 - Released in June 2009 (7 year lag)
 - 180 HAPs + DPM
 - Census tract resolution
- **2005 NATA**
 - Based on 2005 NEI
 - Released in March 2011 (6 year lag)
 - 178 HAPs + DPM
 - Census tract/block resolution
- **2011 NATA**
 - Based on 2011 NEI
 - Release expected in 2015 (4 year lag)
 - Improved temporal and spatial allocations
 - Approximately 178 HAPs + DPM
 - Census tract/block resolution
 - Integrate with CMAQ
 - Improved atmospheric chemistry



2011 NATA



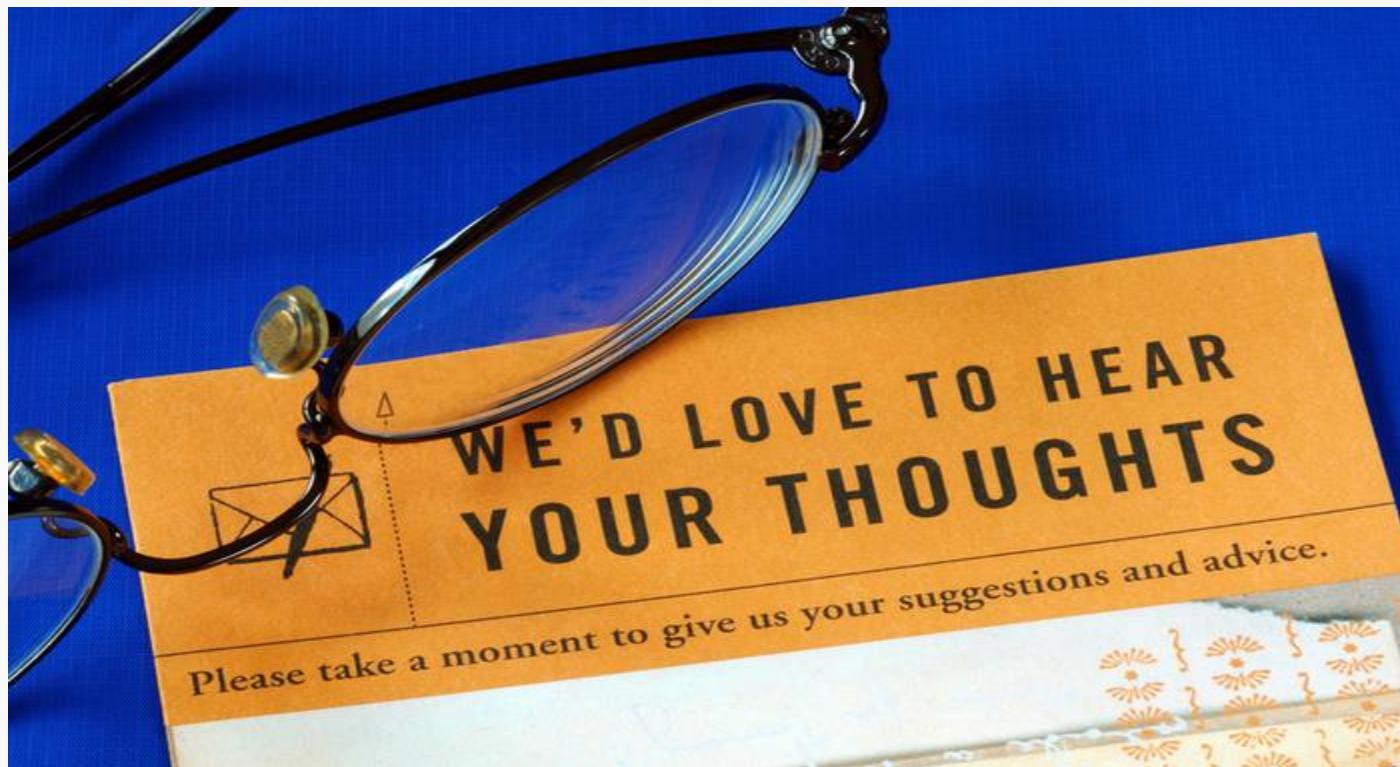


2011 NATA- Current Schedule

- **Fall 2014** - Model with NEI Version 2
- **Winter/Spring 2015** –S/L/T preview of all NATA risk results
- **Spring 2015** - Expected public release



Please give us your feedback...





See Handout for Questions

- Part 1 - Forums to discuss data analyses via workshop or other?
- Part 2- Air Toxics Data analysis Workbook (AMTIC-
<http://www.epa.gov/ttnamti1/toxdat.html#workbook>)
 - Nearly 400 slides -- data preparation, toxics characterization, trends, other analysis techniques
 - Last updated in 2009
 - Have you used it? Suggestions for updating?
 - What thoughts do you have on the need for consistent approaches/business rules?
- Part 3 - Air Toxics Data Archive
(<http://www.epa.gov/ttnamti1/toxdat.html#data>)
 - Do you know about it, use it? Suggested updates?